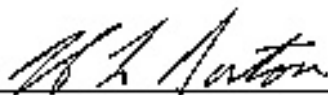


Office of River Protection



December 2000

Office of River Protection
2-Year Progress Report to Congress
December 2000

Approved by: 
Harry L. Boston
Acting Manager,
Office of River Protection

Date: 12/12/00

Executive Summary

As directed by Congress in Section 3139 of the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999*, the U.S. Department of Energy established the Office of River Protection (ORP) at the Hanford Site in eastern Washington State to manage the River Protection Project (formerly the Tank Waste Remediation System), which is the Department's largest and most complex environmental cleanup project. This report fulfills the requirement to submit a report on project progress and management improvements to Congress no later than two years after commencement of operations of the ORP.

ORP is responsible for safe storage, retrieval, treatment, and disposal of 53 million gallons of highly toxic, high-level radioactive waste stored in 177 underground tanks located within seven miles of the Columbia River. One hundred forty-nine of these tanks have a single steel liner inside the concrete tanks and are decades beyond their design life. Sixty-seven have leaked an estimated one million gallons of waste into the soil. Some of this waste has reached the groundwater, threatening the Columbia River. It is urgent that this waste be vitrified (turned to glass) and stored or disposed of in a more secure location before more leaks occur and before tanks and infrastructure deteriorate to the point where the cost and schedule for cleanup becomes prohibitive.

Waste is more safely stored today than two years ago because actions have been taken to close tank waste safety issues, liquids have been pumped out of old tanks, and system upgrades have been made. Significant points of progress include the following.

- Three of four remaining high-priority tank waste safety issues have been

closed; the last one on flammable gas is on schedule to be closed in 2001. The flammable gas issue on the most troublesome tank has been resolved.

- Pumping has been completed on 125 of the 149 aging single-shell tanks, and this effort is ahead of a Consent Decree schedule for completion in 2004.
- Waste storage system safety documentation, equipment, and instrumentation have been upgraded.

Currently, ORP is proceeding to acquire a waste treatment plant (WTP) under a cost-plus-incentive fee completion contract. The ORP was proceeding to acquire privatized waste treatment services from BNFL Inc. However, in May 2000 DOE announced its intention to terminate that contract after BNFL Inc. submitted a proposal that raised serious concerns in many areas including, cost and schedule, management and business approach. The new contract for the WTP was awarded to Bechtel-Washington on December 11, 2000.

Although the privatization contract was terminated, significant progress has been made in acquiring waste treatment capability. Points of progress include the following.

- A robust technical design for the WTP has been independently verified and proven at pilot scale. Process tests with simulated and actual waste have demonstrated that the pretreatment process will meet or exceed requirements.
- The WTP site has been cleared and the infrastructure to support construction and operation of the facility is under

construction. This work should be completed in 2001, ahead of schedule and 10 to 15% under budget.

- The tank farms are being prepared to retrieve and provide waste feed to the WTP. Full-scale mixing pumps were tested and demonstrated the capability to mix the tank waste so it can be pumped to the treatment plant.
- An expedited procurement was conducted to design, build, and commission a new WTP. The contract was awarded on December 11, 2000.

Since ORP was established in December 1998, significant points of management progress include the following:

- The ORP Manager reports directly to the Assistant Secretary for Environmental Management, removing one layer of management and providing more direct access to senior U.S. Department of Energy officials.
- The ORP budget, location, and identity are now separate from the Richland Operations Office.
- The ORP Manager has been delegated authority for contracting, financial management, safety, and general program management equivalent to other U.S. Department of Energy operations offices.
- Several experienced managers and staff members with critical skills have been added.

- DOE acted quickly and decisively in terminating the BNFL Inc. contract and in implementing a contingency plan to complete the design and construct the WTP.
- The tank farm contractor is now a prime contractor to the ORP rather than a sub-contractor to the Hanford Site Management and Integration Contractor. The new WTP contractor will also report to the ORP.
- The River Protection Project (RPP) is being managed as a single, integrated project, and progress has been made in improving project management processes and tools.
- The project underwent an independent assessment in the spring of 2000. The review team concluded that had BNFL Inc. submitted an acceptable proposal the project would be ready to succeed in the technical and regulatory areas, but that additional actions were needed in project management, business and finance, and contract management.

This project will require attention and diligence to meet performance expectations and deliver on promises. The project has enjoyed strong support from Congress and is relying on continued support as merited by the progress made and commitments met in carrying out this important mission.

Contents

1.0	INTRODUCTION	1
1.1	Purpose.....	1
1.2	Background	1
1.3	Regulatory Commitments	2
2.0	RIVER PROTECTION PROJECT PROGRESS.....	3
2.1	Safe Waste Storage	3
2.1.1	Resolution of Tank Waste Safety Issues.....	3
2.1.2	Single-Shell Tank Interim Stabilization.....	6
2.1.3	Managing Tank Space.....	7
2.1.4	Surveillance and Maintenance	7
2.1.5	Worker Safety	9
2.2	Transition to an Integrated Waste Treatment Complex.....	10
2.2.1	Technical Progress in Waste Treatment	11
2.2.2	New Acquisition Approach.....	13
3.0	IMPROVEMENTS IN MANAGING THE RIVER PROTECTION PROJECT	16
3.1	Organizational Improvements.....	17
3.2	Managing Work as One Integrated Project.....	19
3.2.1	Baseline Management Tools Developed.....	19
3.2.2	Baseline Change Control Process Being Upgraded	19
3.2.3	Interfaces Established and Controlled.....	19
3.2.4	Performance Measurement System Being Formalized	20
3.2.5	Risk Management Process Being Standardized.....	20
3.2.6	Life Cycle Model Developed	21
3.3	Relationships with Stakeholders and Regulators	21
4.0	OUTLOOK FOR THE FUTURE	22

List of Terms

DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DST	double-shell tank
HLW	high-level waste
ISMS	Integrated Safety Management System
LAW	low-activity waste
ORP	Office of River Protection
RPP	River Protection Project
SST	single-shell tank
TFC	tank farm contractor
WTP	waste treatment plant

1.0 INTRODUCTION

As directed by Congress in Section 3139 of the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999*, the U.S. Department of Energy (DOE) established the Office of River Protection (ORP) at the Hanford Site. This Office reports to the Assistant Secretary for Environmental Management. ORP is responsible for managing, treating, and disposing of the 53 million gallons of high-level radioactive waste that are currently stored in the Hanford Site's deteriorating underground storage tanks and pose a significant threat to the nearby Columbia River. The ORP manages the largest and most complex environmental project in the nation.



Office of River Protection established.

1.1 Purpose

In the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999*, Congress directed the Secretary of Energy to submit a progress report no later than two years after commencement of ORP operations (i.e., December 2000). This report fulfills that commitment. As directed in the Act, this report is to describe:

- (1) any progress in or resulting from the utilization of the Tank Waste Remediation System; and (2) any improvements in the management structure of the Department at Hanford with respect to the Tank Waste Remediation System as a result of the Office.

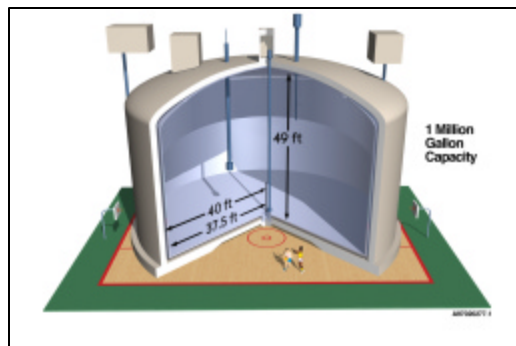
The project name has been changed from the Tank Waste Remediation System to the River Protection Project (RPP) and will be referred to as the RPP throughout this report.

1.2 Background

The Hanford Site in southeastern Washington State has one of the largest concentrations of radioactive waste in the world. That waste is the legacy of 45 years of plutonium production for nuclear weapons, which began with the Manhattan Project in the 1940s and continued through most of the Cold War. Fifty-three million gallons of high-level radioactive waste are stored in 177 underground tanks near the Columbia River, the lifeblood of much of the Northwest, and must be dealt with before more waste leaks to the soil and groundwater. Sixty-seven of the 149 older single-shell tanks (SSTs) have leaked an estimated one million gallons of waste. Some of that waste has been detected in the groundwater that flows to the Columbia River seven miles away. It is critical to treat, immobilize, and dispose of this waste.

Interim measures to minimize the amount of waste that will leak are nearing completion. Focus has shifted from continued waste storage to attaining a permanent solution. A waste treatment plant (WTP) to treat and immobilize the waste is in the early design stage.

The high-level radioactive tank waste will be treated and converted to a glass waste form via a process known as vitrification. Vitrification is the most effective treatment process to produce a durable, stable waste form in which radioactive and hazardous constituents are incorporated and immobilized. Vitrification is the preferred means for treating high-level radioactive waste and has been successfully employed in the United States, France, and England. Once immobilized, the high-level fraction of the waste will be stored on site at Hanford until it can be shipped to a federal geologic repository for permanent disposal. The low activity fraction of the waste will be disposed on the Hanford Site. The project was proceeding to acquire privatized waste treatment and immobilization services from BNFL Inc. However, in May 2000 DOE announced its intent to terminate that contract after BNFL Inc. submitted a proposal that raised serious concerns in many areas, including cost and schedule, management and business approach. ORP is now proceeding to acquire a WTP under a cost-plus-incentive fee completion contract using the process development and design work accomplished by BNFL Inc. Proposals for this new contract were received in October, and a contract was awarded to Bechtel-Washington on December 11, 2000.



Hanford Site high-level waste radioactive underground storage tanks are large.

1.3 Regulatory Commitments

DOE, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology signed a comprehensive Hanford Site cleanup and compliance agreement in May 1989 called the *Hanford Federal Facility Agreement and Consent Order*, commonly referred to as the Tri-Party Agreement. The Tri-Party Agreement is a legally binding agreement for achieving compliance with the *Comprehensive Environmental Response Compensation and Liability Act* remedial action provisions and the *Resource Conservation and Recovery Act* treatment, storage, and disposal unit regulations and corrective action provisions. The Tri-Party Agreement includes legally enforceable commitments and milestones on storing, treating, and disposing of the tank waste.

The following sections describe the progress made on the RPP, including improvements in management that have occurred since formation of ORP.

2.0 RIVER PROTECTION PROJECT PROGRESS

The RPP has two major functions: (1) to continue safely storing the high-level waste (HLW) in the 149 single-shell and 28 double-shell tanks (DSTs) until it can be retrieved for treatment and disposal, and (2) to acquire waste treatment and disposal capability so that a permanent solution can be achieved. Progress in these two areas is described in the following sections.

2.1 Safe Waste Storage

The Hanford Site tank waste is more safely stored today than it was two years ago. Additional safety issues have been resolved, one million gallons of liquid waste have been pumped out of older tanks, and systems have been upgraded.

2.1.1 Resolution of Tank Waste Safety Issues

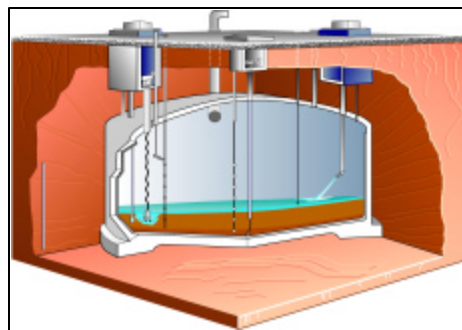
In 1990, tank waste safety concerns led to inclusion of Section 3137 in the *National Defense Authorization Act for Fiscal Year 1991*, calling for the Secretary of Energy to take special precautions on tanks that had serious potential for release of radioactive waste due to increases in temperature or pressure. Tanks that could have serious potential for release of radioactive waste due to increases in temperature or pressure were identified and put on a "Watch List." Special precautions were then taken with those tanks and actions were taken to resolve the safety concerns. Since then, mitigating and resolving these safety concerns have been major project efforts. Recent progress includes the following:

- High-heat safety issue closed
- Criticality safety issue closed
- Organic/nitrate safety issue closed
- Tank SY-101 crust growth remediated
- Number of tanks on Watch List reduced from 28 to 25
- Waste characterization concern resolved.

The resolution of safety issues allows for more efficient, flexible operations so the waste treatment project can proceed.

2.1.1.1 High-Heat Safety Issue Closed

The high-heat safety issue was related to tank C-106 and was resolved in December 1999. Tank C-106 is an SST that was used for high-level radioactive waste storage beginning in mid-1947. High heat was caused by radioactive decay in the sludge in that tank. Beginning in mid-1971, water was added periodically to tank C-106 to keep the sludge wet and to remove the heat by evaporative cooling. Cooling was required to avoid a rise in temperature that could compromise tank integrity. However, this continuous addition of water raised



Hydraulic sluicing nozzle used to loosen sludge.

concerns that the SST could leak radioactive waste into the underlying soil. The issue was resolved by removing the 190,000 gallons of waste and transferring it to a DST designed to handle the heat load.

2.1.1.2 Criticality Safety Issue Closed

The nuclear criticality issue was resolved in September 1999. Because the waste in most of the tanks includes fissionable material (i.e., plutonium), there was concern that the concentration or configuration of the waste could cause a nuclear chain reaction to occur. By sampling and analyzing the waste in tanks with high plutonium content and completing criticality computational analyses, it was determined that this is not a credible event in any tank.

Closing this issue removes one more doubt about tank safety.

2.1.1.3 Organic/Nitrate Safety Issue Closed

Eighteen SSTs were thought to contain unacceptable concentrations of organic chemicals called complexants. The exact concentrations were not known, but there was concern that if one of these tanks overheated or the waste was ignited the organic mixture might react rapidly and possibly cause tank damage that could lead to the release of radioactive materials. This reaction scenario was later shown to have a very low probability of occurrence because the organic chemicals have changed composition and their ignition temperature is much higher than the measured tank temperatures. In December 1998, all 18 tanks were removed from the organics portion of the Watch List.

Two SSTs (tanks C-102 and C-103) were added to the Watch List in 1994 because they contained flammable organic solvents. There were concerns that a floating layer of organic material similar to kerosene could be ignited, releasing radioactivity into the environment. In August 2000, both tanks were removed from the Watch List because sampling and analysis results showed that the possibility of such an event occurring is extremely remote and, even if it happened, consequences to the environment are extremely low.

Upon closing the organic safety issue, the safety authorization basis was revised, allowing removal of operational controls from these tanks. The tanks can now be used more effectively to store and stage waste for transfer to the WTP.

2.1.1.4 Flammable Gas Safety Issue To Be Closed Soon

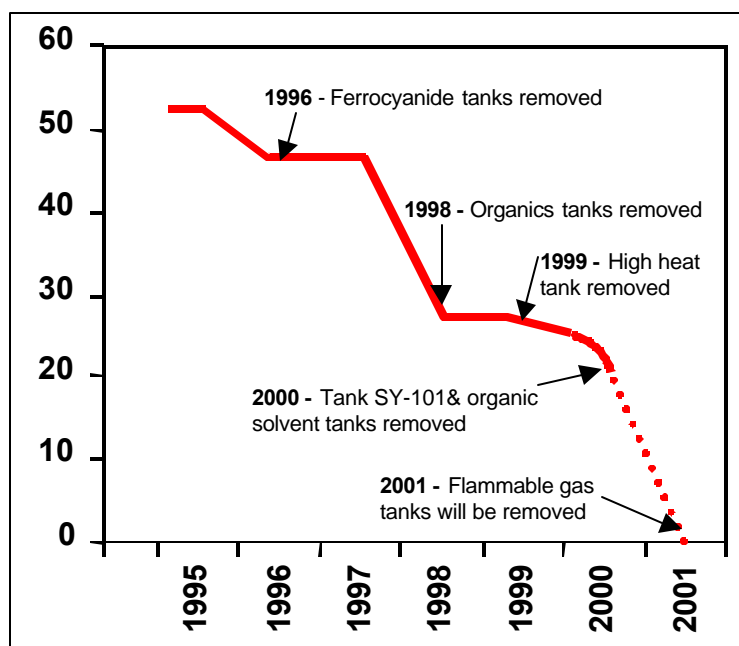
Twenty-five HLW tanks were believed to have a significant potential for flammable gas generation, gas entrapment within the waste, and periodic gas releases to the tank dome space. The issue was that the presence of a flammable gas mixture in the tank and an ignition source could lead to combustion and a release of radioactive waste. Tank SY-101, the most active waste tank, released concentrations of hydrogen in high enough concentrations to support combustion. To mitigate this problem, a mixer pump was installed in tank SY-101 in 1993. Periodic operation of the mixer pump caused the retained gas to be released in small amounts that prevented large gas releases.

However, in 1997 DOE discovered that tank SY-101 was retaining gas in the crust despite operation of the mixer pump. The waste surface was rising and the crust was getting thicker at an accelerating rate. It was projected that the waste level would soon exceed the double containment level of the tank. This problem was resolved by diluting the one million gallons of waste with 400,000 gallons of water and transferring 520,000 gallons of the waste to another DST. It is no longer necessary to operate the mixer pump, and the number of monitoring systems and controls have been significantly reduced.

Flammable gas concentrations in the other 24 tanks on the Watch List have all been far below that measured in tank SY-101. The gas release data obtained during the dilution of tank SY-101 waste and more than five years of hydrogen gas monitoring of those tanks support closure of this safety issue and removing all of these tanks from the Watch List within the next year. The results of the monitoring data have allowed the project to remove ventilation systems and hydrogen gas monitors on the pump pits and domes of SSTs that are being interim stabilized. Progress made toward closing the flammable gas safety issue is already saving millions of dollars each year that is being applied to tank waste cleanup.

2.1.1.5 Number of Tanks on Watch List Reduced

ORP is committed to removing all tanks from the Watch List by September 30, 2001 (a Tri-Party Agreement milestone). Excellent progress has been made as shown below.



Number of tanks on the Watch List declining.

2.1.1.6 Waste Characterization Concern Closed

The Defense Nuclear Facilities Safety Board (DNFSB) provides independent, external oversight of DOE activities affecting nuclear health and safety and makes recommendations to the Secretary of Energy. The board recommended DOE undertake a comprehensive reexamination and restructuring of the waste characterization effort. After years of waste sampling and analysis, coupled with evaluation of historical tank waste records, a revised characterization and

safety strategy evolved and was successfully implemented. The resulting documentation was submitted to the DNFSB in November 1999 and the recommendation was closed. As a result of this work, waste characterization is now being done more efficiently and the data collected has enabled the project to resolve safety issues, design and develop the waste treatment and immobilization processes, and select the waste feed for Phase 1 treatment in the WTP.

2.1.2 Single-Shell Tank Interim Stabilization

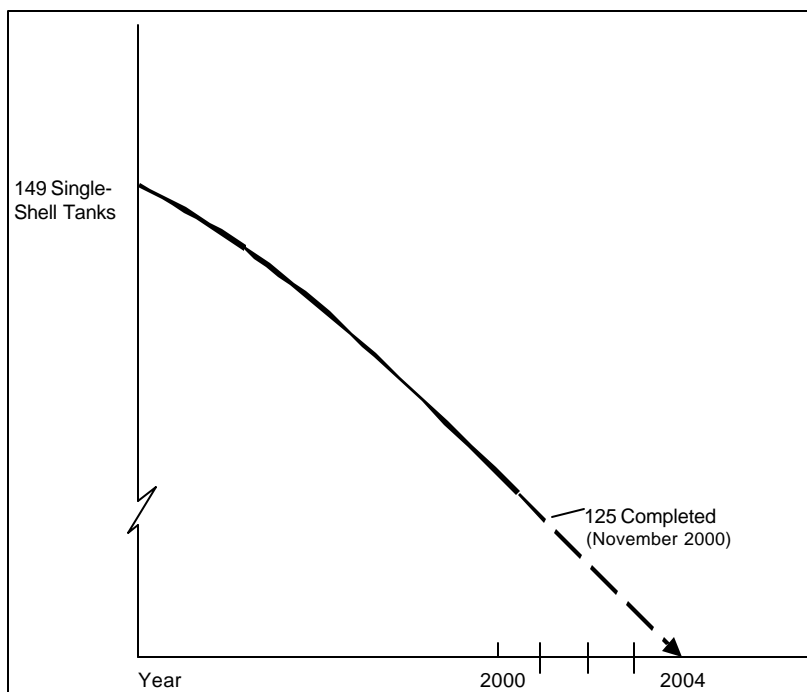
To reduce the potential for SST waste to leak to the vadose zone (the soil between the surface and the groundwater), an interim stabilization approach was developed to remove as much liquid as possible from the SSTs. All but 30 of the 149 SSTs were interim stabilized before 1997, and the Interim Stabilization Program was restarted in late 1998. A Consent Decree was entered by the U.S. District Court for the Eastern District of Washington in September 1999 establishing specific milestones for (1) starting to pump the remaining tanks, (2) removing a certain percentage of the pumpable liquid from the remaining tanks, and (3) completing all SST interim stabilization by September 2004.

ORP has met all Consent Decree milestones ahead of schedule. The following outlines the status of SST interim stabilization:

- Pumping initiated on 17 tanks since June 1998
- Pumped one million gallons of liquid waste from SSTs to DSTs
- Interim stabilized 6 tanks.



Innovative double hose system rather than steel piping used to transfer single-shell tank liquids.



Interim stabilization of single-shell tanks ahead of Consent Decree schedule.

2.1.3 Managing Tank Space

Twenty-eight DSTs are available for tank farm waste management activities and are key for receiving waste retrieved from SSTs and transferring it to the WTP. Effective management of tank space is extremely important because there is limited space available in the tanks. The DSTs are the only tanks that can receive liquid HLW as they are the only tanks that meet hazardous waste storage requirements. Additional DSTs may be needed as the project progresses but will only be constructed as a last resort because new tanks would be expensive, take funds away from waste treatment and disposal, and eventually require cleanup and closure themselves.

A 6.5-mile cross-site transfer line between the Hanford Site 200 East and 200 West Areas was completed in May 1998. The transfer line provides a conduit for pumping liquid waste from the aging SSTs in the 200 West Area to the newer DSTs in the 200 East Area. Since the transfer line became operational in the summer of 1998, three million gallons of liquid waste have been transferred between tank farms.

A waste evaporator is used to remove water from tank waste and reduce the waste volume. In the past two years, evaporation has reduced tank waste volume by 1.5 million gallons.

There are restrictions on mixing various types of wastes in the DSTs due to compatibility concerns. However, during the past two years, ORP has been able to ease some restrictions on segregating waste containing organic chemicals.

These actions have enabled the project to manage and store the waste without building additional tanks. Projections indicate that the 28 tanks should provide adequate space for several more years.

2.1.4 Surveillance and Maintenance

Tank waste and tank farm equipment are monitored 24 hours per day, 7 days per week, to ensure that the waste is safely stored. The annual cost of tank farm surveillance and maintenance is approximately \$100 million. Some of the improvements made in surveillance and maintenance are described in the following sections.

2.1.4.1 Safety Authorization Basis Updates and Efficiencies

ORP has completed a safety analysis of tank farm operations based on modern standards and documented that analysis in a final safety analysis report approved in March 1999. The Technical Safety Requirements to which the tank farms operate were then revised to reflect those specified in the final safety analysis report. These actions have greatly simplified the safety management process. This year, new waste characterization data and flammable gas release information from retrieving tank SY-101 waste are being used to reanalyze the safety basis with the goal of removing any unnecessary controls and thereby increasing operating efficiency.

2.1.4.2 Double-Shell Tank Integrity Evaluations

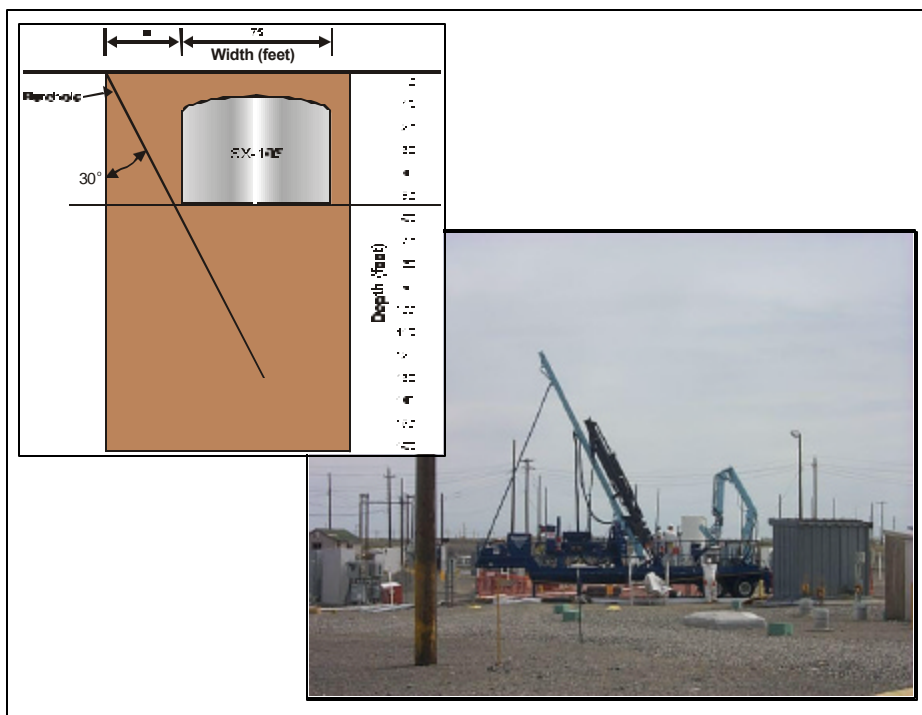
The 28 million-gallon DSTs are the only tanks that meet requirements for receipt and storage of liquid HLW. It is critical that these tanks remain sound and serviceable for as long as possible as the project needs to continue using them for decades until the waste from all 177 tanks has been treated and immobilized.

During the past two years the effort to evaluate and ensure DST integrity has been increased. The walls of six tanks were ultrasonically examined and found to be sound, and all 28 DSTs will be examined by 2005. Nine other small catch tanks and transfer tanks were also examined. A sophisticated corrosion probe was installed in one of the DSTs to provide real time waste corrosion data and other corrosion prevention measures are being taken, such as adding chemicals to adjust the waste alkalinity.

2.1.4.3 Vadose Zone Investigations

The vadose zone is the sediment between the ground surface and the water table. The ORP Tank Farm Vadose Zone Project serves two purposes: (1) to collect information to define the nature, extent, and movement of contamination in the soil due to leaks and spills of SST waste and (2) to use the collected data to determine whether immediate mitigating actions are necessary to prevent additional environmental degradation. Information on tank waste contaminants in the environment is important for the following:

- Planning and implementing near-term actions to protect groundwater
- Understanding the implications of tank leaks during waste retrieval and applying controls
- Developing technical requirements for the eventual closure of the Hanford Site tank farms.



First ever slant borehole drilled under a Hanford Site single-shell tank.

After negotiations with the Washington State Department of Ecology, a Corrective Action Program was initiated to develop an understanding of the impacts of SST waste leaks and to determine what corrective measures should be taken.

Field work completed includes collecting subsurface samples while decommissioning an existing characterization borehole, constructing two new characterization boreholes, and shallow characterization using a cone penetrometer. Spectral gamma logging reports for three SST farms and addenda to all spectral gamma logging reports, incorporating information from updated equipment and analytical techniques, were completed.

Leak-tight caps were installed on all monitoring drywells in SST farms to eliminate this potential pathway for water to move contaminants deeper in the soil. A workshop on interim surface barrier concepts was conducted, and an engineering study was completed that made recommendations on how to reduce water infiltration at SST farms. The study results are currently being implemented.

2.1.5 Worker Safety

ORP is responsible for ensuring that work performed on the RPP is conducted efficiently and in a manner that protects workers, the public, and the environment. The RPP worker safety record is much better than the Bureau of Labor Statistics national average, and ORP and its contractors are working to make it even better.

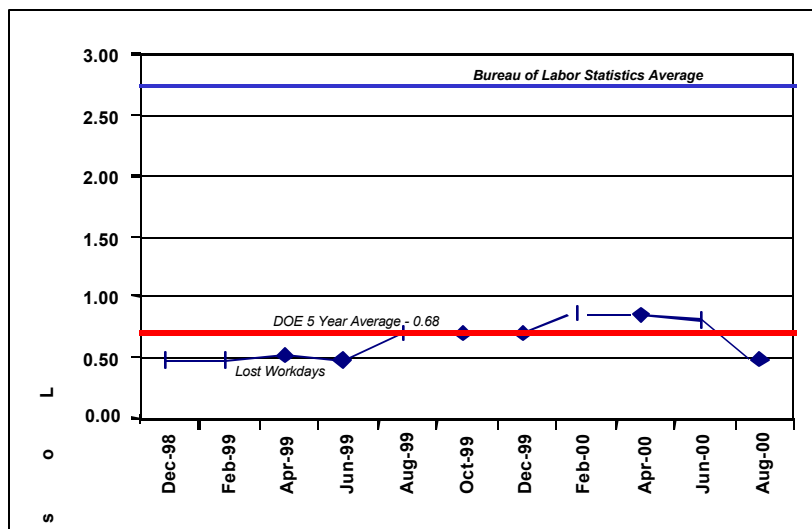
2.1.5.1 Implemented Integrated Safety Management System

The DOE *Integrated Safety Management System* (ISMS) specifies a formal, organized process for integrating safety, health, and environmental considerations into all types of work for all types of potential hazards. To implement this program, ORP developed the *River Protection Project Environment, Safety and Health Policy* and the *Office of River Protection Integrated Safety Management System Description*.

The tank farm contractor (TFC), CH2M HILL Hanford Group, Inc., revised its ISMS description to reflect its new status as a prime contractor to ORP. The revised system description has been approved by ORP and the management assessment of the contractor's ISMS implementation plan has also been completed. ORP made a formal declaration of institutionalization of ISMS in July 2000.

2.1.5.2 Worker Safety Better Than National Average

The TFC lost workday rate continues to be far below the Bureau of Labor Statistics average and slightly lower than the DOE five-year average. During the past year, the Occupational Safety and Health Administration recordable days-away cases for the TFC were down 25%, even though the hours worked increased 13%. Moreover, the TFC recently achieved a milestone of one million worker hours completed without a lost work day injury, the third time in the past three years that this has been achieved. In addition to protecting the worker, safe operations are efficient operations resulting in more cleanup progress.



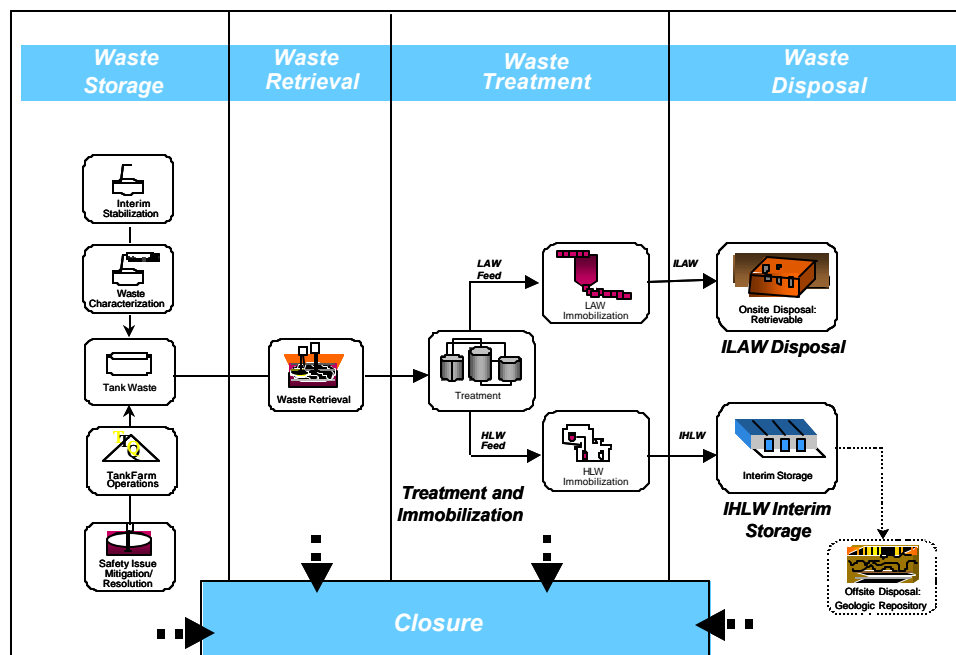
Tank farm contractor lost workday rates are far below national average.

2.2 Transition to an Integrated Waste Treatment Complex

During the Hanford Site's plutonium production years, the tank farms accumulated and stored high-level radioactive waste with little attention given to its eventual treatment and disposal. By the end of the Cold War in 1991, the tank farms' physical condition and management had deteriorated. The results were in-tank waste safety issues, a weak safety culture, poor conduct of operations, and inadequate management. Since then most of these deficiencies have been corrected.

As the cleanup of Hanford Site tank waste begins, the tank farms must now function as part of a waste treatment complex. The tank farms must be (1) safely and efficiently operated and maintained to store the waste to be treated, and (2) upgraded and operated to retrieve the waste and deliver it to the treatment plant. The tank farms are an integral part of the waste storage, treatment, and disposal system. It is from this perspective that the RPP is upgrading the tank farms and acquiring waste treatment and disposal capability.

ORP is moving forward with Phase I of the waste treatment and immobilization portion of the RPP life cycle. This phase entails retrieval, treatment, immobilization, and storage or disposal of at least 10% of the tank farms waste by mass and 25% of the tank waste by activity by 2018. Processing the Phase I waste will free up crucial tank space to transfer waste currently stored in the older SSTs to newer, safer DSTs. After retrieval from the tanks, the waste will be separated into HLW and low-activity waste (LAW) fractions so that most of the radionuclides and less than 10% of the other waste materials are in the HLW fraction with the remainder in the LAW fraction. Both wastes will be immobilized by vitrification and poured into steel containers. The LAW will be disposed of on the Hanford Site and the HLW will be stored on the Hanford Site until it can be shipped to a geologic repository for disposal.



Tank waste storage, retrieval, treatment, and disposal process.

2.2.1 Technical Progress in Waste Treatment

The RPP technical progress has been sufficient to give ORP confidence in proceeding with construction and operation of the Phase I WTP. Despite the decision to terminate privatization of waste treatment services, the privatization contractor's technical design was sound and the interim successor contractor, the RPP TFC, advanced this work. Prominent technical progress during the past two years includes: process tests with simulated and actual waste have demonstrated that the separations processes will meet or exceed contract requirements, and a one-third-scale melter has exceeded design capacity by 50% during pilot plant demonstration runs. These successes generate a high level of confidence that the plant will meet processing requirements.

2.2.1.1 Waste Treatment Process Development

Under the privatization approach, the contractor initiated an extensive and well-planned process development program to accomplish the following:

- Identify the process design and equipment systems to treat the tank wastes
- Establish the basis and approach for environmental permitting and safety authorization
- Demonstrate that the immobilized (vitrified) tank waste would meet waste disposal requirements.

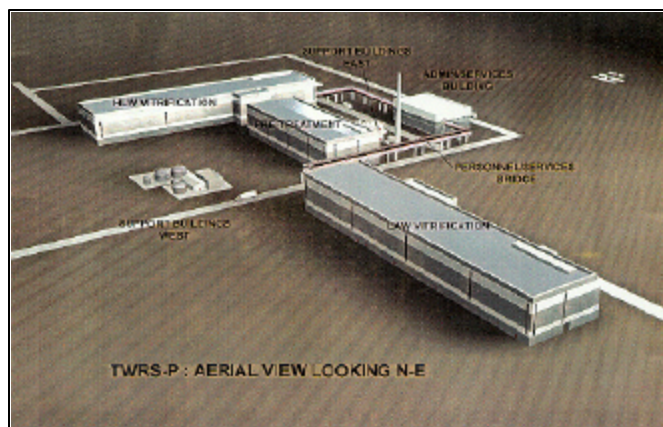
While conducting this technology development program, the following major accomplishments were achieved.

- Pretreatment processes for removing key radionuclides were demonstrated using actual radioactive wastes. Test results exceeded requirements for producing an immobilized LAW form.
- Glass waste form samples of immobilized LAW and HLW were shown to meet DOE requirements.
- Design capacity tests of a one-third-scale pilot scale glass melter met glass production rates for both the LAW and HLW glass melters.



Simulated low-activity waste vitrification demonstrated in one-third-scale pilot plant melter.

2.2.1.2 Waste Treatment Facility Design



Artist's concept of waste treatment plant.

The WTP will be comprised of three major facilities: pretreatment, HLW vitrification, and LAW vitrification. Additional supporting facilities will include an administration building and an analytical laboratory. The WTP design was approximately 15% complete at termination of the privatization contract. This level of design was sufficient to fix the process flowsheet, process equipment components, civil structural and architectural layout of the facilities, and overall site layout. Initial seismic evaluations of the pretreatment and HLW vitrification facilities were completed

and information was developed to support an initial construction authorization request.

Using information developed from the process and facility design, the privatization contractor prepared a cost estimate and a detailed schedule of activities for project completion. DOE used this cost and schedule information to prepare the Government Fair Cost Estimate that was used in the WTP procurement under a cost-plus-incentive fee contract approach (described in Section 2.2.2).

2.2.1.3 Waste Retrieval and Delivery

The WTP is only part of the overall process of tank waste storage, retrieval, treatment, and disposal. Excellent progress has been made in the tank farms in preparing to retrieve and provide waste feed to the WTP. The SST waste retrieval sluicing system performed beyond expectations in removing approximately 190,000 gallons of mostly sludge from tank C-106 while resolving the high-heat safety issue associated with that tank. The full-scale DST mixer pump test conducted in tank AZ-101 demonstrated the capability to mix the sludge and liquid in these tanks so it can be transferred to the WTP. Additional waste tanks have been sampled and the waste characterized to ensure waste feed will be available if the WTP is operated at a higher

capacity. Waste transfer lines, valve assemblies, and tank ventilation upgrades have also been completed.

2.2.1.4 Waste Treatment Plant Infrastructure

Infrastructure must be provided for the new WTP. ORP and its TFC have made excellent progress in the past two years in this area. A 65-acre site has been cleared and prepared for construction of the WTP and the required infrastructure is being installed. Work completed to date includes access roads, raw water lines, and potable water lines. Construction work in progress



Transformers being delivered to power the future waste treatment plant.

includes running electrical power lines to the WTP site, building an electrical substation, and installing liquid effluent transfer systems. This work will be completed in 2001, ahead of schedule and 10 to 15% under budget.



2.2.2 New Acquisition Approach

The new acquisition approach is to use a cost-plus-incentive fee contract to design, construct, and commission the WTP and then issue a solicitation for an operations contractor. This approach builds on the good work that was done by contractors, regulators, and DOE during the privatization effort and avoids any significant delays in moving forward with design and construction of the WTP. The commitment is to achieve hot start by 2007 and complete processing of 10% of the tank waste mass and 25% of the radioactivity by 2018.

The solicitation for the WTP, issued in August 2000, invited competition and included performance incentives to minimize cost, accelerate schedule and provide efficient and reliable waste treatment facilities. The solicitation also maintained beneficial aspects of having the new WTP contractor accept a portion of the performance risk.

2.2.2.1 Unified Contracting Strategy

ORP has adopted a contracting strategy that makes its contractors accountable for their work on the RPP by providing both positive and negative performance based incentives. Both major contracts for RPP work are now assigned to ORP as prime contracts. The first contract is the tank farms contract which is responsible for ensuring safe storage and retrieval of the tank waste; storage and disposal of immobilized waste products; and decontamination, decommissioning, and initiation of post-closure monitoring of the tank farms. The second major contract is for designing, constructing, and commissioning the new WTP. After the WTP is commissioned, the WTP construction contractor will be replaced by a WTP operations contractor.

Both the tank farms contract and the WTP contract are cost-plus contracts with incentive features. The tank farms contract has annual performance incentives for project accomplishments and for implementing technologies or processes that achieve better, faster, and cheaper results.

The WTP contract has a fee structure that includes incentives for cost reduction, schedule acceleration, and facility operational performance. An important feature of this fee structure is that, while the contractor may receive provisional fee payments during the course of the contract, this fee is not actually earned until the contractor successfully completes hot commissioning. Successful hot commissioning requires that the facility achieve specified throughputs for specified periods of time while processing actual tank waste to produce specification-compliant waste forms. If hot commissioning is not successfully completed, the contractor must repay all provisional fee payments that it has received that are in excess of the minimum fee specified in the contract.

2.2.2.2 Acquisition of New Waste Treatment Plant Contractor

A new WTP contract was awarded on December 11, 2000 to Bechtel-Washington. Every effort was made to streamline the acquisition process for the new WTP contractor to ensure timely contract award and strong competition. These efforts included: pre-solicitation information exchanges with industry, use of a paperless acquisition process, availability of an electronic reading room, web site information distribution, use of a draft solicitation, use of oral presentations, and award without discussions. The acquisition process was carried out on the following schedule:

Issued draft Request for Proposals	July 31, 2000
Issued final Request for Proposals	August 31, 2000
Received proposals	October 20, 2000
Completed oral presentations	October 27, 2000
Awarded contract	December 11, 2000

The contractor was selected using criteria chosen principally to evaluate the proposed technical approach, key personnel qualifications, project management, and experience and past performance. The WTP contractor must provide a number of near-term deliverables including submission of the WTP project baseline and selection of the WTP commissioning subcontractor by April 15, 2001.

2.2.2.3 External Independent Review of Waste Treatment Strategy

In early 2000, an external independent review of the RPP was conducted in response to a Congressional mandate that directed DOE to use non-proponent bodies to review large new-start projects. The purpose of the review was to determine whether the scope of the project, including technology and management, cost and schedule baselines, and contingency provisions, were valid and credible and would result in the successful acquisition of a WTP.

The independent review team was experienced in the project functional areas being examined: Project Management, Business and Finance, Contracting and Capital Finance, Technical Processes, Nuclear Waste Processing, Nuclear Regulation, Environmental, and Facilities and Construction. The external independent review was conducted from February through June 2000, encompassing the time when the BNFL Inc. proposal was received and rejected. The overall conclusion of the report that is currently relevant was that the RPP was on track and

ready to succeed with the construction and operation of a vitrification plant if an acceptable proposal had been provided by the privatization contractor.

However, the external independent review did identify some deficiencies in the ORP capability and readiness to manage the next phase of the RPP. Specifically, the review recommended the following actions.

- DOE should understand the factors contributing to the unexpected and unacceptable price from the privatization contractor.
- Mutually acceptable roles and responsibilities, accountabilities and authorities between DOE Headquarters and ORP should be defined.
- Key management and staff vacancies at ORP should be filled on a priority basis.
- DOE should preserve its investment in the project – those areas that are ready to succeed should be maintained as the project moves forward.
- Implementation of integrated project management systems should be completed on a priority basis.
- A viable path forward should be defined and implemented using the lessons-learned from the privatization effort.

DOE and ORP accepted these recommendations and are acting on them. The conclusions and recommendations of the independent review are documented in *The External Independent Review of the River Protection Project (Tank Waste Remediation System) Task B Report, Detailed Review and Analysis*, dated July 24, 2000.

3.0 IMPROVEMENTS IN MANAGING THE RIVER PROTECTION PROJECT

In 1998, Congress directed DOE to establish the Office of River Protection and to implement several management actions. Those actions have been implemented as follows:

- The Office is headed by a senior official of DOE who reports to the Assistant Secretary of Energy for Environmental Management.
- The ORP Manager is responsible and accountable for managing all aspects of the RPP.
- The Secretary of Energy has provided the Office with the resources and personnel to manage the project in an efficient and streamlined manner.
- The Assistant Secretary of Energy for Environmental Management has delegated to the ORP Manager authority for contracting, financial management, safety, and general program management that is equivalent to the authorities of managers of other DOE Operations Offices.
- The ORP Manager coordinates all activities of the Office with the manager of the Richland Operations Office.

Improvements in the management structure as a result of the Office include:

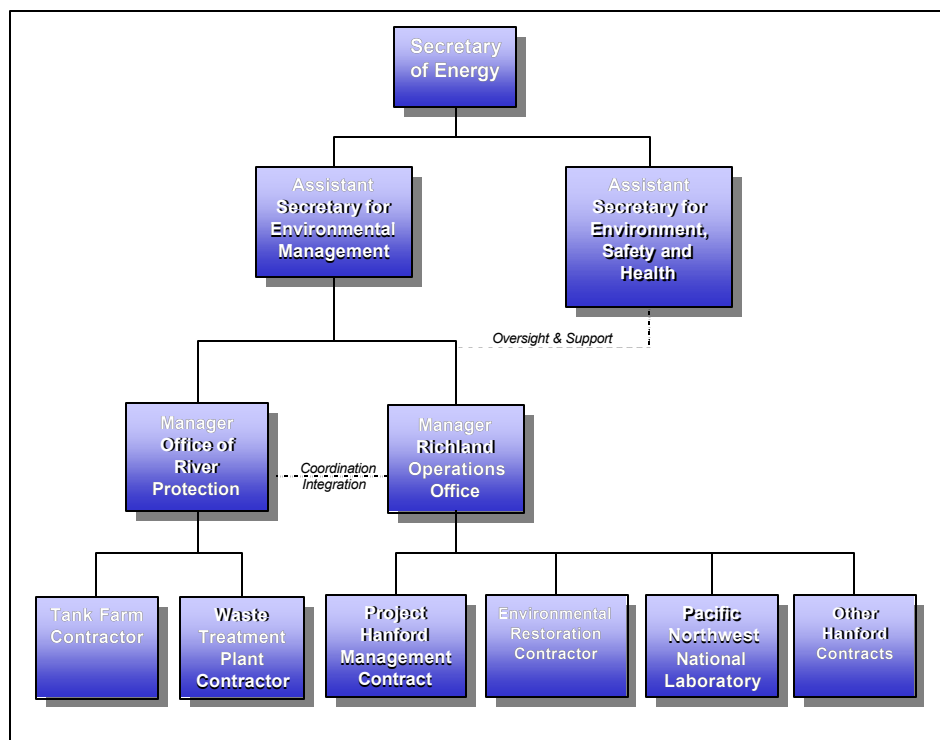
- The ORP has established a separate identity, funding, and reporting relationship from the DOE Richland Operations Office. This separation has increased the visibility of the project within DOE and with the stakeholders, and enabled ORP resources to be fully focused on this project.
- The Office is able to attract and retain more senior managers because additional senior manager positions were approved when ORP was delegated authorities equivalent to other DOE Operations Offices.
- ORP is organized to manage the RPP as a single, integrated project. The ORP is responsible to assure the work of the two prime contractors is fully integrated and focused on accomplishing the project mission.
- ORP has consolidated project safety management. Responsibility for the safety of all of the RPP facilities and operations is now within ORP. This consolidation will ensure completeness and consistency.
- More authority has been delegated to the ORP resulting in focused and faster decision making. The solicitation and award of the \$4 billion contract for the new WTP contractor in a six-month period is one example. The Northwest regulators and stakeholders have long been proponents of more local control.

These and other improvements in managing the RPP are discussed in the following sections.

3.1 Organizational Improvements

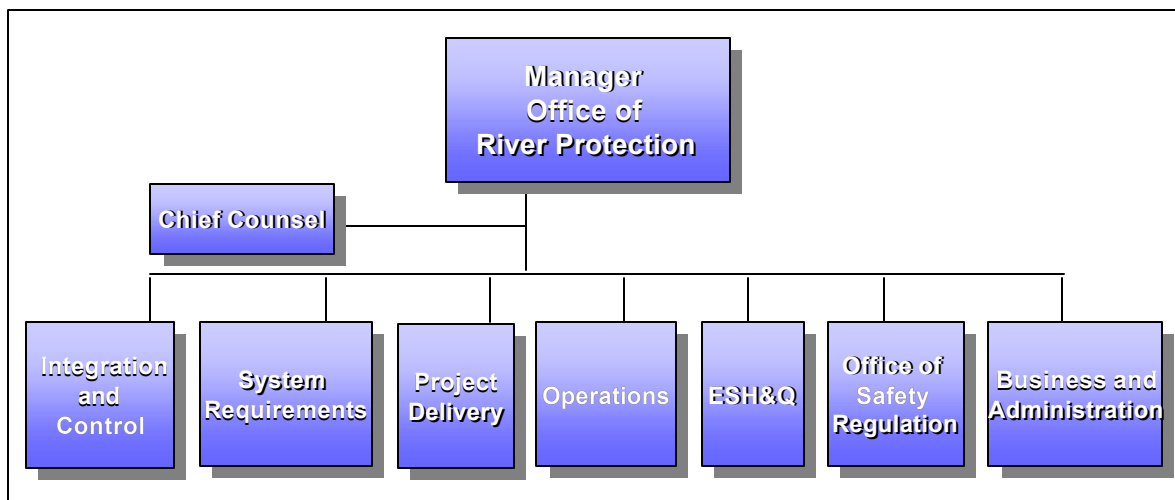
A more streamlined and effective reporting relationship has resulted from the Manager of ORP reporting directly to the Assistant Secretary for Environmental Management. This has provided more direct access to key decision-makers at DOE Headquarters.

A Memorandum of Agreement among the Office of Environmental Management, the Richland Operations Office, and ORP documents the organizational authorities, roles, and responsibilities of each office and establishes a reporting structure. The primary interface role of the Richland Operations Office with ORP is to ensure effective integration between ORP and other Hanford Site activities. The Richland Operations Office also provides administrative and technical support to ORP upon request; maintains responsibility for Hanford Site safety, security, and regulatory compliance; and acts as the signatory authority for certain Hanford Site-wide permits and agreements.



ORP reporting relationships.

ORP has obtained DOE Headquarters agreement to hire additional staff members to manage the RPP activities.



The ORP organizational structure has been modified to better manage the new WTP acquisition approach.

Progress in Radiological, Nuclear and Process Safety Management

ORP is continuing the established radiological, nuclear, and process safety management program for the WTP and is continuing to implement the five principles of good regulation that have been articulated by the Nuclear Regulatory Commission: independence, openness, efficiency, clarity, and reliability. With termination of the privatization contract, the Regulatory Unit staff and all the radiological, nuclear, and process safety functions previously performed by the Regulatory Unit have been transferred to ORP. Also, because of the importance and cost of the WTP, the Office of Environmental Management is establishing a DOE Headquarters WTP Monitoring Group to provide an onsite presence to support the headquarters line management oversight mandated by DOE policy. This realignment of the radiological, nuclear, and process safety functions is consistent with the intent of Congress that the ORP Manager have the same authorities as other field offices, including safety as set forth in Section 3141 of the *Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001*. Additionally, the Office of Environment, Safety and Health has responsibilities for policy-setting, independent oversight, and enforcement.

The radiological, nuclear, and process safety management program requires the WTP contractor to tailor safety requirements to the specific hazards of proposed processes while meeting applicable laws, regulations, and top-level safety standards and principles. During the privatization contract period, the privatization contractor prepared an initial safety assessment, identified safety standards and requirements, and prepared an integrated safety management plan. These documents were approved by the Regulatory Unit.

The new WTP contractor is expected to use these approved documents to advance the design, culminating in revised nuclear safety documents that will include a preliminary safety analysis report when the contractor seeks construction authorization in fiscal year 2002. ORP will review and approve all new and revised safety documentation.

3.2 Managing Work as One Integrated Project

Improvements have been made in ORP project management systems. ORP manages the RPP as a single project. This management approach is designed to handle a large and complex project such as the RPP, ensuring integration among RPP prime contractors, ORP, and the Richland Operations Office. Key features include assembling an experienced and dedicated management team, clarifying roles and responsibilities, and implementing disciplined and proven project management systems. While project management systems have been in use for some time, these systems are being upgraded to focus on the key mission objective of building and operating a waste treatment complex.

3.2.1 Baseline Management Tools Developed

Project scope, schedule, and cost are merged into a single RPP baseline, maintained under configuration control, and managed through the change control process. A master integrated, logic-networked life cycle schedule was completed in April 2000 in accordance with a common specification mutually agreed to by ORP and its prime contractors. The schedule provides a time-phased plan with a logical sequence of interdependent activities, milestones, and events necessary to carry out the project mission. This schedule illustrates and integrates all TFC and WTP contractor schedule data in a single master schedule, which is the fundamental tool for managing and controlling the baseline. The scheduling system also provides a basis for measuring progress and assessing project opportunities and risks, and identifies and depicts conflicting schedule dates and critical path concerns so corrective action measures can be taken. The integrated mission schedule was completed in August 2000. Other baseline schedules and documents are being prepared and will be regularly updated.

3.2.2 Baseline Change Control Process Being Upgraded

The RPP baseline has been under configuration control since April 2000. ORP is developing a single, integrated change management process for managing and controlling both technical and programmatic changes. An ORP change management directive for the RPP will be implemented by December 2000, including training. Proposed changes are subjected to a detailed evaluation for life cycle schedule and cost impacts to the RPP baseline, as well as interfaces between RPP functions and organizations. The process ensures that all work being performed meets baseline requirements and that the impacts of changes to the baseline are adequately considered before any actions are taken. Baseline changes are reviewed based on the need to meet or change technical requirements, mitigation of risk to the RPP, and overall life cycle schedule and cost efficiency.

3.2.3 Interfaces Established and Controlled

The RPP is an unusually complex project. For the entire project to be successful, all organizations must do their jobs well and on time. It is crucial that all project interfaces are well understood and that the responsibilities and processes for making these interfaces function are clearly laid out. The key ORP interfaces are designed to ensure those needs are met. Items flowing across the interfaces can be categorized as follows:

- Physical quantities (e.g., waste feed, immobilized products, water, electricity)
- Information (e.g., requirements, performance documents, reports, planning documents)
- Funds (e.g., payments).

An interface management process has been established for the RPP to control technical, administrative, and regulatory interfaces. An Interface Working Group composed of technical and management staff from ORP and contractor organizations defines, documents, controls, and manages each RPP interface. Interface documentation is baselined and placed under change control. The Interface Management Team is a joint ORP contractor, senior-level team tasked with responsibility to ensure successful exchange of materials and services through issue-tracking and to arbitrate issues that are not resolved by the Interface Working Group.

Interface management ensures that management control exists for the interfaces and that the controls are appropriate. ORP uses several types of vehicles to ensure that interfaces are managed, including memoranda of agreement, memoranda of understanding, interface control documents, and letters. Interface control documents define the technical details of the interfaces between ORP and its contractors, and between contractors.

3.2.4 Performance Measurement System Being Formalized

A formal performance measurement system is being established to assess RPP progress and to provide visibility to problems that need management attention. The system will measure progress by evaluating actual performance against the project baseline schedules and cost estimates. Particular attention will be given to activities on the critical path. Both contractors and ORP will report on project performance in regularly scheduled review meetings. Performance against other key indicators important to project success will also be measured.

3.2.5 Risk Management Process Being Standardized

Risk management is an integral part of project management. ORP is establishing a standardized, structured process for identifying, analyzing, and controlling risks. The process manages risk proactively from project initiation to completion. This results in a decreased likelihood of potential cost overruns, schedule delays, and compromises in system quality.

Two principal types of risks have been identified. Baseline risks are the set of specific uncertainties in the cost, ability to perform scope, and schedule of specific activities in the integrated project baseline. These risks are analyzed quantitatively (particularly for potential cost and schedule impacts), and managed by project managers responsible for that part of the work. Organizational risks are typically qualitative in nature and are not directly tied to specific project baseline activities. Organizational risks may include stakeholder, funding, workforce, regulatory, or contractual issues and concerns. By employing prioritized project risk information (both qualitative and quantitative), the project managers and ORP management team can jointly focus attention on gaining early management control of the highest-risk activities.

3.2.6 Life Cycle Model Developed

The RPP Life Cycle Model was completed in May 2000. It was used in updating the baseline and is being used extensively for studying technology alternatives and strategic analysis. The Life Cycle Model is an integrated and comprehensive project-planning tool designed to summarize the key impacts of proposed changes to the established baseline. This tool enables decision makers, senior management, and staff to graphically illustrate and summarize the current baseline and how changes in key project parameters impact the cost, schedule, and risks to workers and the public. The Life Cycle Model covers the entire RPP mission and improves the understanding of how RPP performance would respond to changes in key aspects of the project (e.g., facility start-up dates, design parameters, and tank retrieval sequencing and timing). The major project performance measures reported through the model are the life cycle project cost, project schedule, system logistics, and human health risks.

3.3 Relationships with Stakeholders and Regulators

The Pacific Northwest's interests in Hanford Site cleanup are represented by a diverse collection of states (Washington and Oregon), tribes, and environmental and other stakeholder groups. These organizations have identified the Hanford Site tanks as one of the most urgent environmental threats to the Northwest and strongly support moving ahead with the RPP.

ORP is working to reach agreement on milestones that are consistent with the schedule required to build and start up the very large, complex WTP. The recent agreement reached to modify the Consent Decree (i.e., to include a milestone for awarding the WTP contract by January 15, 2001) supplants the Tri-Party Agreement requirements for DOE to have authorized the WTP contractor by August 2000 to proceed with design and construction as required by the terminated privatization contract.

Progress was also made on another contentious issue concerning the schedule for retrieving SST waste. Agreement was reached on a Tri-Party Agreement revision that would focus on SST retrieval demonstrations and retrieval of high-risk waste first rather than requiring early retrieval of lower-risk waste from a large number of nearly empty tanks.

The Deputy Secretary and the ORP Manager recently met with senior Washington State officials to find ways to work together in a more cooperative manner. Both parties have the same goal, cleaning up the Hanford Site tank waste.

4.0 OUTLOOK FOR THE FUTURE

Despite aging and deteriorating tanks and infrastructure, ORP has made significant progress in maintaining safe operations of the Hanford Site tank farms and in reducing the threats of the stored waste to the environment, the workers, and the public. The waste is stored more safely today than it was two years ago because safety issues have been closed, liquids have been pumped out of older tanks, and system upgrades have been made.

ORP has embarked on a path that will remediate Hanford Site tank waste safely and on an acceptable schedule. When the privatization contractor submitted an unacceptable proposal to provide waste treatment services in privatized facilities, the Secretary of Energy terminated the privatization acquisition approach and ORP swiftly issued an RFP for design, construction, and commissioning of an equivalent WTP under a different contracting approach. Proposals were received in October 2000, and ORP awarded the contract on December 11, 2000.

At this time, ORP is focused on initiating construction of the WTP to be able to start hot operation in 2007. Phase I of the WTP operation will treat 10% of the waste by mass and 25% of the radioactivity by 2018. ORP remains committed to completing treatment of all the waste and has begun to analyze options for the best way to carry out the balance of the mission. A baseline for completing the balance of the mission will be developed, including identification of high-payback science and technology investments necessary to complete the mission.